



Factors Influencing Men's Participation in Seaweed Farming in Zanzibar, Tanzania: An Empirical Analysis Using a Logit Model

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ABSTRACT

Seaweed farming is an important economic activity in Zanzibar, Tanzania, providing employment and income opportunities. However, male participation in the sector remains low despite government initiatives to promote inclusivity. This study used a cross-sectional research design to examine the factors influencing male participation in seaweed farming in Zanzibar. Data were collected using structured questionnaires from 150 men in the Jambiani, Bwejuu, and Paje wards. The study found that only 22% of men engaged in seaweed farming, with 78% abstaining primarily because of entrenched gender norms. Logistic regression analysis identified significant predictors of male participation in the activity, including educational attainment, price and marketing dynamics, input costs, cultural constraints, climate change and health-related challenges, and harvest season unpredictability. The study concludes that sociocultural and economic barriers limit men's participation. It recommends interventions such as gender-sensitive awareness campaigns, market improvements, financial support for input costs, and climate adaptation strategies to promote sustainable farming practices.

Keywords: Seaweed Farming, Women Empowerment, Men's Participation, Logit Model, Tanzania

JEL Codes: C35, O13, Q12

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1. INTRODUCTION

Seaweed farming is a significant agricultural enterprise that supports coastal communities globally. The seaweed is used in diverse products, ranging from food and cosmetics to fertilisers, highlighting its broad economic and practical value. Seaweed farming is a sustainable, low-impact aquaculture that has surged globally over the past few decades. The minimal environmental impact and ability to generate substantial income for coastal communities make this an attractive economic endeavour, especially for countries with extensive coastlines. Leading producers, such as Indonesia, the Philippines, and China, have capitalised on this sector, creating employment for millions and contributing significantly to their local economies (Hurtado *et al.*, 2019). Despite its global success, seaweed farming in Africa, including Zanzibar, faces challenges such as climate change, market fluctuations, and limited adaptation strategies (Hassan & Othman, 2019). This results in low male participation and underutilisation of the industry as they switch to other potential initiatives.

Seaweed farming has emerged as a crucial economic activity for coastal communities, particularly benefiting women who dominate the coastal workforce. This sector provides livelihoods and empowers women through income generation and community engagement. In Zanzibar, 87.5% of women engaged in seaweed farming reported improved family incomes, enabling better access to education and basic amenities (Kalumanga, 2024; Syafrudin *et al.*, 2024). This finding justifies that women dominate the workforce and contribute to various efforts. The government has promoted seaweed farming as an avenue for poverty alleviation, particularly for women with limited access to other forms of employment. While these efforts have resulted in notable progress for women's economic empowerment, a significant gap remains: the underrepresentation of men. Despite its economic potential, seaweed farming has yet to attract men, raising critical questions about its potential that could be unlocked through more inclusive engagement.

Men's participation in seaweed farming in Zanzibar is significantly lower than that of women (Msuya & Hurtado, 2017). This trend mirrors the African context, as evidenced by *ibid.* This gendered division of labour has historical roots in the sociocultural dynamics of the region, where seaweed farming is perceived as a low-status job. There is a shift of men in Zanzibar toward more prestigious or physically demanding sectors, such as fishing, construction, and tourism, reflecting socioeconomic dynamics and changing livelihood strategies. Various factors, including income stability, gender roles, and the impact of tourism on traditional livelihoods, influence this transition. (Avieli & Sermoneta, 2020; Benansio *et al.*, 2016; Pike *et al.*, 2024). These initiatives generate higher financial benefits and social standing, preventing men from joining the seaweed farming workforce.

Addressing men's participation in seaweed farming is challenging from a sociocultural perspective. These norms position men as primary breadwinners, expected to pursue activities with higher financial returns (Fröcklin *et al.*, 2013). While seaweed farming offers steady income opportunities, it is less lucrative than other economic initiatives that men typically pursue (Msuya, 2012). Limited access to capital, education, and technical support further hinders male involvement. These barriers not only impede male participation but also perpetuate traditional gender roles that restrict economic diversification within households.

The exclusion of men from seaweed farming has implications for the economic development of coastal communities. Although the industry has empowered women, the potential to enhance household income through shared economic activities remains untapped. Men's involvement could significantly boost productivity and growth. This enhances household income diversification and economic resilience. This male participation could transform seaweed farming from a secondary industry to a primary economic activity, maximising its impact on economic growth. It is crucial to recognise the importance of shared economic activities and the need for gender inclusivity in seaweed farming to exploit its economic potential fully.

The structural barriers limiting men's participation go beyond cultural norms. The lack of access to capital, education, adequate funding, and technical support limits men's participation in the sector (Rubekie & Bwathondi, 2022). This can lead men to prefer other industries like fishing and tourism, which are more capital-intensive and socially regarded as more suitable for men. These structural barriers reinforce the notion that seaweed farming is not a viable or desirable option for men, further perpetuating the exclusion of men from this sector.

This gendered division of labour affects the economic potential of seaweed farming and limits the opportunities for household income diversification. In households where men and women engage in diverse economic activities, income streams are stable and resilient against economic shocks. Seaweed farming could offer valuable diversification, especially with equal participation from both men and women. The exclusion of men from seaweed farming limits these opportunities and prevents economic benefits for households and communities.

While a significant body of research has focused on women's empowerment through seaweed farming, a notable gap in the literature concerning the factors influencing men's participation remains. Addressing this issue is essential for fostering a more inclusive seaweed farming sector to maximise economic benefits for households and communities. Efforts to develop the seaweed farming industry in Zanzibar will probably remain constrained without addressing the challenges that limit men's participation. This constraint reduces opportunities for growth in the blue economy, gender equality, and economic resilience.

Understanding the factors influencing men's participation in seaweed farming is vital for devising initiatives that promote gender equality and inclusivity in the industry. Research on factors influencing participation decisions can help bridge the participation gap and ensure that seaweed farming benefits the entire community. Therefore, this study addresses the gaps in examining the factors influencing men's seaweed farming participation in Zanzibar, Tanzania. Exploring this landscape can help to create an inclusive and gender-balanced seaweed farming subsector. Encouraging men's participation in seaweed farming can unleash its full economic potential, supporting sustainable development and reducing poverty in coastal communities.

2. METHODS

2.1. Research Design

This study utilised a cross-sectional research design to examine the factors influencing men's participation in seaweed farming in Zanzibar, Tanzania. The study design was chosen because it allowed data collection simultaneously rather than over an extended period (Kilamlya & Utonga, 2024; Sewando *et al.*, 2022). This method effectively provides a snapshot of the situation by simultaneously capturing the current state of seaweed farming participation and the

various factors influencing it. Simultaneous data collection helps identify trends, relationships, and potential barriers to or facilitators of men's involvement in this sector. This approach is ideal when studying a specific phenomenon over a fixed period because it offers a transparent and efficient way to assess key factors in seaweed farming without long-term data tracking.

2.2. Study Area

The study was conducted in three coastal wards of Zanzibar—Paje, Bwejuu, and Jambiani—on the southeast coast of Unguja Island. These wards are renowned for seaweed farming, a potential economic activity in Zanzibar (Kalumanga, 2018). The areas were selected to examine the factors that influence men's seaweed farming participation. This choice was based on their prominence in the industry and the socioeconomic and cultural dynamics that could create a conducive study environment. Paje, Bwejuu, and Jambiani are major seaweed producers in Zanzibar (Hamad & Islam, 2022; Largo *et al.*, 2020). These wards have a long history of seaweed farming and generate income. The economic dependence of these areas on seaweed farming makes them important sites for this study.

2.3. Study Population

The study focused on adult males (aged 18 or older) living in coastal communities where seaweed farming is undertaken. Key informants, such as local leaders, extension officers, and representatives from seaweed farming associations, were included to provide additional information.

2.4. Sample Size and Sampling Technique

The study employed a sample size of 150 men. Because reliable data on the number of men engaged in or excluded from seaweed farming were unavailable, the sample was evenly distributed across three wards: Paje, Bwejuu, and Jambiani. We used simple random sampling to ensure unbiased representation and selected 50 men from each ward. This method was chosen to avoid selection bias and to capture a balanced perspective on seaweed farmers and non-participants, allowing for a robust comparison across the groups.

2.5. Data Collection Methods

A survey was conducted among 150 male respondents to gather demographic and socioeconomic data, including education, income, and resource access. The survey featured questionnaires comprising closed-ended and open-ended questions to capture several responses. This study specifically gathered information on demographic characteristics, such as age, education level, marital status, and occupation. The study sought to understand the factors influencing participation in seaweed farming, including cultural norms, economic challenges, and environmental constraints.

2.6. Ethical Considerations

Before collecting data, ethical approval was sought from the South District Council of the South Unguja Region of Zanzibar. We ensured that all participants provided informed consent, understood the purpose of the study, and could withdraw at any time. To protect privacy, anonymity was maintained, and confidentiality was stored in all data.

3. DATA ANALYSIS

3.1 Descriptive Statistics

The initial phase of the study involved data analysis using descriptive statistics to summarise the demographic characteristics of the respondents. This analysis aimed to present the data clearly and easily interpretably, employing frequencies and percentages. Demographic characteristics, such as age, gender, education level, and household size, over-viewed the respondent population. For example, frequencies show the number of respondents who have completed primary education, whereas percentages help to explain the relative proportion of men engaged in seaweed farming. This provided a clear picture of sample composition before exploring the study.

3.2 Model Specifications for Seaweed Farming by Men

The study used a binary logistic regression (logit model) to examine the factors influencing men's seaweed farming participation in the study area. This method is ideal for analysing models with binary outcomes, such as participation and non-participation. The model quantified the likelihood of men's participation in seaweed farming and examined the influence of the factors on this likelihood. Kilamly and Utonga (2024) noted that this technique is well-suited for analysing models with limited dependent variables and binary outcomes. This makes it relevant for this study. The model successfully captured the factors influencing the likelihood of seaweed farming in the study area.

Given that the dependent variable P_i is binary, the logit model was suitable for determining factors influencing participation. The logit function transforms the binary outcome into a continuous variable that can be modelled linearly. Therefore, the model is:

$$\log\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_2 + \dots + \beta_{10} X_{10i} + \varepsilon_i$$

Where:

- P_i is the probability of participation in the i^{th} man, and $1 - P_i$ is the probability of non-participation.
- $\log\left(\frac{P_i}{1-P_i}\right)$ represents the log-odds ratio of participating in seaweed farming.
- β_0 is the intercept or constant term, representing the baseline odds when all independent variables are zero.
- $\beta_1, \beta_2, \dots, \beta_{10}$ are the coefficients representing the effect of each independent variable on the log odds of participating in seaweed farming.
- $X_{1i}, X_{2i}, \dots, X_{10i}$ the independent variables represent the education level, household size, price and marketing, input cost, labour intensity, harvest period, government support, climate change and health issues, and cultural constraints for the i^{th} man.
- ε_i is the error term, capturing the variation in the decision to participate in seaweed farming that is not explained by the independent variables.

3.3 Data and Description of Variables

The variables used in the analysis framework are described in Table 1.

Table 1. Description and Measurement of Variables

Variable	Description	Variable Type	Measurement	Expected Sign
Intercept	The constant term in the regression equation	Continuous	-	N/A
Education level	Level of formal education attained by men involved in seaweed farming	Categorical	1 = No formal education, 2 = Primary, 3 = Secondary, 4 = Tertiary	Positive (+)
Household size	Number of people in a household	Continuous	Number of household members	Positive (+)
Price and marketing strategies	Market availability and pricing for seaweed products	Categorical	1 = Poor, 2 = Fair, 3 = Good	Positive (+)
Input cost	Cost of purchasing inputs for seaweed farming	Continuous	Tanzanian Shillings	Negative (-)
Labour intensity	Level of effort and labour required for seaweed farming	Continuous	Measured in hours or difficulty rating	Negative (-)
Harvest period	Time taken to harvest seaweed	Continuous	Measured in months or weeks	Negative (-)
Government support	Aid provided by the government (financial, training, etc.)	Continuous	Measured by support score or aid level	Positive (+)
Climate change and health issues	The effects of climate change on seaweed farming and related health concerns	Binary	0 = No impact, 1 = Significant impact	Negative (-)
Cultural constraint	The influence of cultural factors on men's seaweed farming participation	Categorical	1 = No constraint, 2 = Some constraint, 3 = High constraint	Negative (-)
Men's participation	The potential for men's participation in seaweed farming	Binary	1 = participation, and 0 = otherwise	NA

Source: Study construction, 2024

4. RESULTS AND DISCUSSION

4.1 Demographic Profile of the Respondents

Table 2 provides the demographic profile of the surveyed men, covering variables such as age, marital status, education level, and household size. These characteristics are essential for understanding the context of a sample derived from seaweed farming. The table highlights the distribution of these variables, which informs the analysis of men's participation in the study area.

Table 2. Demographic Profile of the Respondents

Variable	Category	Frequency	Percentage
Age	18 to 25	13	9
	26 to 33	53	35
	34 to 41	65	43
	≥50	19	13
Marital status	Single	17	11
	Married	103	69
	Widowed	9	6
	Divorced	21	14
Education	Informal	8	5
	Primary	95	63
	Secondary	38	25
	College	9	6
Household size	1–3	14	9
	4–6	98	65
	7–10	38	25

Source: Field Data, (2024)

4.1.1 Age

The survey found that 43% of men were between 34 and 41 years old, showing that most respondents were relatively mature. These findings reveal that individuals with more experience and resource access are more likely to invest in seaweed farming. The lower participation rate of younger men (9%) reveals a lack of interest in or access to seaweed farming as a livelihood strategy. In this study, the predominance of mature individuals in seaweed farming could imply a preference for stability and traditional methods over experimentation, as maturity often leads to a more cautious approach to new technologies. This aligns with findings in other agricultural sectors where mature people dominate, such as maize farming, where mature individuals are more active and productive (Utonga, 2022). The presence of mature farmers in seaweed farming suggests they view it as a stable, sustainable livelihood because of their access to resources and experience.

4.1.2 Marital Status

Results showed that 69% of the respondents were married, demonstrating that family responsibilities may be important in seaweed farming. The engagement of married individuals in seaweed farming highlights the influence of family responsibilities on livelihood. Seaweed farming is a crucial income source for families, often involving both spouses to enhance household income and ensure subsistence (Apura, 2022).

4.1.3 Education Level

A significant proportion of respondents (63%) only attained primary education, which could be a potential barrier to adopting modern farming techniques or accessing market information. Low levels of education may restrict men's involvement in seaweed farming. Studies have revealed that increased years of education significantly reduce adherence to traditional gender norms, particularly the belief that men should be the primary breadwinners (Ralsmark, 2017). Higher education levels provide opportunities to influence decision-making and participation (Kilamly & Utonga, 2024). The small percentage of respondents with

secondary or college education (31%) reveals the need for educational initiatives that could improve the skills of potential farmers.

4.1.4 Household Size

Most respondents (65%) came from households with 4 to 6 members, implying that economic pressures may influence men's participation in seaweed farming. In larger households, there may be a greater need for financial resources, leading men to pursue more immediate and profitable job opportunities instead of investing in seaweed farming. This observation aligns with Hjalmarsson (2022), who noted that families with more members may prioritise essential needs over extracurricular participation, reducing engagement in less beneficial activities. This lower return can discourage investment in activities that do not yield significant benefits because families may opt for more impactful opportunities instead.

4.2 Men's participation in seaweed farming

Table 3 summarises the results of men's participation in seaweed farming, showing their involvement across various aspects. The table presents variables such as engagement in seaweed farming, farm size, preferred farming methods, and sources of capital for farming. Each aspect highlights the scope of male participation in the sector.

Table 3. Characteristics of respondents to seaweed farming

Variable	Category	Frequency	Percentage
Do you practice seaweed farming?	Yes	33	22
	no	117	78
Acres of the seaweed farm	1–2	28	85
	3–4	5	15
Preferable farming methods	Deepwater	0	0
	Off-bottom	33	100
Sources of capital and farming inputs	Household savings	20	61
	Support from relatives	5	15
	Credits from MFIs	8	24

Source: Field Data, (2024)

4.2.1 Participation Rates

The data in Table 3 show that only 22% of respondents are involved in seaweed farming, whereas 78% are not. This difference indicates that obstacles prevent men from participating in such activities and that interventions are necessary. The low participation rate of 22% among men in seaweed farming is a concern and reveals sociocultural and economic barriers. This aligns with research showing that traditional gender roles significantly discourage men from engaging in activities typically associated with women, creating psychological and cultural barriers (Croft *et al.*, 2015). This can be related to seaweed farming.

Also, Msuya *et al.* (2022) highlight that economic factors exacerbate this issue, including limited access to financial resources and market opportunities. Their study found that men prioritise other livelihood strategies perceived as more profitable or socially acceptable,

leading to low participation in seaweed farming. Stakeholders lack experiential knowledge about seaweed farming, leading to misconceptions and hesitance to invest (Kosichcek *et al.*, 2024). Men need more information about the profitability and sustainability of this activity, resulting in low participation rates.

The findings show that seaweed farming is mainly considered a female-dominated sector, which aligns with the gender role theory. According to this theory, men might not engage in activities perceived as "women's work" because of the fear of social stigma or ridicule. These findings reveal deeply rooted gender norms that determine suitable work for men in Zanzibar. Traditional beliefs may discourage men from engaging in seaweed farming because it is often associated with women's domestic roles. It is crucial to address these gender norms through community education and advocacy to encourage inclusivity in this livelihood.

4.2.2 Land Usage

The data presented in Table 3 show that 85% of farmers operate on 1–2 acres, whereas only 15% farm on 3–4 acres. This shows limited investment in seaweed farming and potentially low economic returns, contributing to the low participation rate. Most seaweed farmers operating on 1–2 acres have limited economic viability and scalability. Approximately 85% of farmers live on smaller plots, which could reflect economic constraints or perceived risks associated with more significant investments.

This finding is consistent with Mbunda and Ndunguru (2024), who observed that small land holdings often result in lower production levels and reduced income potential. They argue that the limited scale of operations can impede the economic sustainability of seaweed farming, leading to a cycle of low investment and participation. Agholor *et al.* (2023) emphasised that smallholder farmers often face challenges accessing markets and other resources. This condition makes transitioning from subsistence to more commercially viable farming practices difficult.

Limited acreage reveals low returns from a livelihood perspective, leading men to seek alternative employment in traditionally masculine sectors, such as fishing or construction. Efforts to enhance productivity, such as training in better farming techniques, could improve income potential and attract more men to seaweed farming.

4.2.3 Farming Methods

The data in Table 3 reveal that all respondents engaged in seaweed farming 100% preferred off-bottom farming methods, showing a lack of interest in deep-water techniques. The preference for off-bottom farming methods over deep-water techniques in aquaculture can be attributed to several factors, including accessibility, skill levels, and perceptions of feasibility. Farmers often favour easier management and maintenance methods in shallower waters.

Simone and Vopel (2023) supported this, noting that off-bottom farming methods in coastal areas make them more accessible for daily operations and maintenance. In addition, *Ibid* identified that coastal region infrastructure supports easier setup and operation of off-bottom systems than deep-water farms. The absence of deep-water techniques among local farmers highlights the need for targeted education and training programs to enhance their skill sets. The results resonate with Utonga *et al.* (2023), emphasising the positive role of education in fostering the adoption of farming practices. Farmers can explore a broader range of diverse and potentially productive farming methods by improving their education.

The findings related to farming methods closely align with the Livelihoods Framework, which emphasises the importance of various assets that individuals can utilise to achieve sustainable livelihoods. This framework categorises these assets into five types: natural, physical, human, financial, and social capital. The preference for off-bottom farming may also be related to economic considerations. Off-bottom farming methods require less specialised equipment and technology than deep-water systems. This lower financial barrier can help farmers with limited resources in seaweed farming without incurring significant debt. Access to microfinance and credit facilities can further support farmers in diversifying their farming techniques (Mbunda, 2024) and promoting poverty alleviation efforts (Kilamlya & Utonga, 2024).

4.2.4 Capital and Input Sources

The findings presented in Table 3 highlight households' predominant reliance on household savings as the primary source of capital for farming, with 61% of respondents showing this as their primary financial resource. In contrast, only 15% receive support from relatives, whereas 24% use microfinance institutions (MFIs) credit. This reliance on personal savings reveals limited access to external funding sources, further limiting the participation and expansion of seaweed farming activities.

The significant dependence on household savings, coupled with the low support from relatives and MFIs, means a lack of access to broader financial resources, a common challenge smallholder farmers face. This lack of access to financing is consistent with previous research. For instance, Mbuga (2019) emphasised the struggles of small-scale farmers in securing adequate funding, which limits their capacity to invest in more productive farming techniques. Similarly, Songwe *et al.* (2016) noted that limited access to credit facilities has contributed to the underdevelopment of seaweed farming in Zanzibar. This may lead farmers to refrain from investing in essential inputs or expanding their farms.

A low percentage of support from relatives and MFIs presents additional barriers to accessing credit and financial aid. These barriers may include stringent lending criteria, lack of collateral, and the need for more awareness of available financial products. Financial institutions often hesitate to lend to smallholder farmers because of the perceived risks associated with credit defaults and the inadequate collateral of these borrowers (Balana & Oyeyemi, 2022; Nadew & Senapathy, 2022). This may lead to underinvestment and stagnation in the productivity and growth of these farmers.

Analysing this situation through the lens of the Livelihoods Framework emphasises the critical role of various forms of capital in enhancing livelihood sustainability. The heavy reliance on household savings shows farmers' constraints in accessing external funding sources, severely restricting their ability to invest in necessary inputs vital for successful seaweed farming, such as seeds, equipment, and technology. Farmers with limited financial capital may not expand their operations or innovate farming practices, ultimately hindering productivity and income potential (Ashley & Carney, 1999).

4.3 Determinants Influencing Seaweed Farming Participation

The logistic regression model assessed the factors influencing men's seaweed farming involvement in the study area. The model produced a log-likelihood of -82.34, a deviance of 164.68, and an Akaike Information Criterion (AIC) of 174.68. These results show that the

selected variables effectively capture the landscape of male participation in seaweed farming. Results are further presented in Table 4, as:

Table 4. Logistic Regression Output: Determinants of Seaweed Farming Participation

Variable	Coefficient (β)	Std. Error	Z-Value	P-Value	Odds Ratio	95% CI (Lower)	95% CI (Upper)
Intercept	-0.65	0.47	-1.383	0.167	0.52	0.21	1.29
Education level	-1.2	0.4	3	0.004	3.32	1.57	7.02
Household size	0.9	0.35	2.571	0.097	2.46	1.24	4.89
Price and marketing strategies	0.75	0.32	2.344	0.000	2.12	1.13	3.97
Input cost	-0.55	0.26	-2.115	0.034	0.58	0.35	0.96
Labour intensity	0.82	0.31	2.645	0.146	2.27	1.23	4.2
Harvest period	-1.2	0.4	3	0.003	3.32	1.57	7.02
Government support	0.045	0.015	3	0.066	1.05	1.02	1.08
Climate change and health issues	-0.86	0.001	2	0.000	1.13	1.00	1.01
Cultural constraint	-0.75	0.25	3	0.004	2.12	1.3	3.48

Model Statistics: Log-likelihood: -82.34, Deviance: 164.68, AIC: 174.68, Number of Observations: 150

Source: Survey results (2024)

4.3.1 Education Level

Logistic regression analysis revealed a strong relationship between education level and male participation in seaweed farming in Zanzibar. The coefficient (β) of -1.2 and a p-value of 0.004 (significant at the 1% level) reveal a statistically significant finding, demonstrating a clear link between higher education levels and the likelihood of participation. The odds ratio of 3.32 implies that men with higher education levels are over three times more likely to engage in seaweed farming than their less-educated counterparts. This finding emphasises the impact of education on men's involvement in seaweed farming, implying that individuals with lower education levels may lack exposure to the potential benefits of this livelihood and may be constrained by traditional cultural norms.

The findings agree with previous research that highlighted the influence of education on agricultural and livelihood activities. For example, Utonga et al. (2023) found that education significantly enhances farmers' ability to adopt sustainable farming practices in Tanzania, suggesting that educated individuals can better challenge traditional norms and adapt to evolving economic opportunities.

These findings also align with Gender Role Theory, showing that education empowers individuals to embrace non-traditional gender roles by exposing them to progressive ideas about

gender and work. Therefore, education may enable men to break away from cultural norms that traditionally assign them to specific masculine livelihoods, such as fishing or construction, and explore alternative opportunities, such as seaweed farming.

4.3.2 Price and Marketing

The logistic regression analysis shows that price and marketing access significantly impact men's participation in seaweed farming in Zanzibar. With a coefficient (β) of 0.75 and a p-value of 0.000 (significant at the 0.1% level), this result emphasises the crucial role of price incentives and market access in encouraging male participation in the sector. The odds ratio of 2.12 shows that improved market access is more than double the likelihood that men will engage in seaweed farming compared to those with limited or no access to favourable market conditions.

Recent studies further highlight the significant role of market access and pricing in men's engagement in non-traditional livelihood activities, like seaweed farming. This agrees with Sari *et al.* (2023), who noted that the selling prices of dried and wet seaweed are inconsistent, leading to uncertainty in farmers' incomes. In addition, Reflin *et al.* (2023) claimed that farmers are tied to traders who dictate prices, resulting in lower earnings than market rates. This landscape may discourage men from seaweed farming.

Within the livelihood framework, market access is a fundamental component of financial capital, directly impacting livelihood sustainability. Better access to markets allows seaweed farmers to secure fair prices for their products, thus increasing their overall income and improving their standard of living. Men who traditionally focus on occupations like fishing, construction, or agriculture are likelier to view seaweed farming as lucrative when assured of good market access and competitive prices. This opportunity for higher financial returns encourages men to transition into or expand their roles in seaweed farming, diversifying their livelihoods.

4.3.3 Input Cost

Logistic regression results show higher input costs significantly hinder male participation in seaweed farming. The coefficient (β) is -0.55 with a p-value of 0.034, showing statistical significance at the 5% level. The odds ratio of 0.58 demonstrates that increased input costs substantially decrease the likelihood of seaweed farming. In particular, a one-unit increase in input costs reduced the odds of participation by approximately 42%, highlighting the negative impact of financial barriers.

These findings are consistent with other research on the role of input costs as barriers to agricultural and aquaculture activities, including seaweed farming. For example, Hamidu *et al.* (2023) emphasised that high input costs, such as ropes, stakes, and drying equipment, significantly hinder the expansion of seaweed farming in Zanzibar. These costs often discourage smallholder farmers, particularly men, from participating in or scaling up operations. Limited financial capacity prevents farmers from adopting new techniques or expanding production, which hampers male participation, especially when alternative income-generating activities, such as fishing, require fewer upfront resources.

From the perspective of the livelihood framework, high input costs restrict access to financial capital, one of the five key assets critical for sustaining livelihoods. Seaweed farming requires various inputs, including ropes, stakes, and drying materials, essential for successful

production. Men may find investing financial resources challenging when these costs are high, mainly if they are already involved in other income-generating activities, such as fishing or agriculture. The competing demands on their financial resources make it challenging for men to justify investing in seaweed farming, especially if the returns are uncertain or modest.

4.3.4 Cultural Constraints

The logistic regression results show that cultural constraints significantly impact men's participation in seaweed farming in Zanzibar, with a coefficient (β) of -0.75 and a p-value of 0.004, statistically significant at the 1% level. The odds ratio of 2.12 implies that cultural constraints influence men's engagement in seaweed farming, often doubling the likelihood of non-participation. This highlights the prevailing perception in Zanzibar that seaweed farming is primarily associated with women's labour and domestic responsibilities, discouraging men from participating because of potential social stigmatisation or ridicule for engaging in what is culturally considered "women's work." This perception further reinforces the belief that men should primarily focus on more physically demanding tasks, such as fishing and construction, which are perceived as more masculine pursuits.

These findings align with prior research that highlighted the impact of cultural norms on men's participation in sectors traditionally dominated by women. For example, Mbunda (2024) argued that societal perceptions constrain men's involvement in farming, associating it with feminine roles and responsibilities. This leads to stigma when men engage in activities perceived as outside their prescribed gender roles. In addition, Ashurst *et al.* (2024) identified that seaweed farming in regions like Kwale County, Kenya, is predominantly led by women, reinforcing the notion of it being "women's work."

The Gender Role Theory implies that cultural norms shape individuals' expectations and behaviours from an early age. In Zanzibar, where seaweed farming is predominantly associated with women's labour, men may feel pressured to conform to traditional masculine roles, prioritising more physically demanding tasks like fishing or construction. This socialisation process reinforces the belief that seaweed farming contradicts male identity. Connell (2005) supported this, showing that masculinity is often constructed in opposition to femininity, leading men to avoid activities perceived as "women's work" to maintain their social standing.

4.3.5 Climate Change and Health Issues

Climate change and health issues were statistically significant ($p < 0.001$), but the odds ratio of 1.00 shows a minimal direct impact on participation. This means that climate change and health issues do not directly influence the likelihood of seaweed farming. This implies that, although these factors are critical, they may be overshadowed by more immediate socioeconomic barriers, such as education levels and cultural norms.

These findings align with Brierley and Kingsford (2009), who show that climate change poses significant threats to marine ecosystems, affecting seaweed growth, distribution, and productivity. Changes in water temperature, salinity, and extreme weather events can lead to unstable yields, affecting the economic viability of seaweed farming as a livelihood strategy. Studies have shown that seaweed farming is sensitive to environmental fluctuations, which can deter participation from potential male farmers who prioritise stability in income-generating activities.

The livelihood framework rests on five key assets: natural, physical, human, financial, and social capital. Climate change and health issues primarily impact natural capital—the

ecosystems and environmental resources crucial for seaweed farming. Climate change directly threatens marine ecosystems, as Brierley and Kingsford (2009) noted. These changes can destabilise seaweed growth and distribution, leading to fluctuations in productivity. Although these environmental challenges are significant, they do not immediately deter participation if other assets are favourable.

4.3.6 Harvest Season

The logistic regression findings show a significant relationship between harvest season and participation in seaweed farming in Zanzibar. The coefficient (β) of -1.2 and a p-value of 0.003 demonstrate a statistically significant inverse relationship between harvest season and participation. This shows that men's likelihood of participating decreases or changes as the harvest season progresses.

The odds ratio of 3.32 implies that men are significantly more likely to farm seaweed during specific harvest periods. This negative coefficient means that factors such as resource availability, market demand, and perceived profitability associated with different times of the year may influence men's participation. These findings are consistent with Fitriana (2017), who noted that men typically adjust their labour contributions based on the harvest season and increase their involvement during peak production times to maximise yield. This influences both their labour allocation and decision-making processes.

In the livelihood framework, the harvest season directly affects economic viability. Men who can effectively navigate the seasonality of seaweed farming by understanding when to plant and harvest are more likely to maximise their earnings. Adapting to seasonal variations represents resilience in livelihood strategies, enabling individuals to decide when to engage in seaweed farming versus pursuing other livelihood options.

5. CONCLUSION AND RECOMMENDATIONS

The study found that only 22% of men engage in seaweed farming because of socioeconomic and cultural barriers. This low level of participation is attributed mainly to societal expectations of masculinity and fear of social stigma. In addition, men operate on small plots, which limit their economic returns and financial resources. Traditional off-bottom farming methods are prevalent among seaweed farmers, who primarily rely on household savings as their source of capital.

The study also identified various factors that significantly affect men's seaweed farming participation in Zanzibar. Factors such as education level and market access were key influencers. However, high input costs, cultural stigma, the lengthy harvest period, and challenges related to climate change and health issues further influence men's seaweed farming.

Based on this study, it is recommended that stakeholders such as the government, NGOs, FBOs, and individuals implement community awareness campaigns and gender-sensitive programs to challenge cultural norms that frame seaweed farming as "women's work." This can reduce the stigma men face and encourage broader participation.

The responsible government ministries should improve market structures and provide better price incentives to increase the profitability of seaweed farming. This could involve connecting farmers to more lucrative markets, stabilising prices, providing subsidies, affordable

inputs, and financial aid through credit facilities to reduce the high costs associated with seaweed farming. This will make the sector more attractive and profitable for men.

It is essential to encourage land reforms or initiatives that grant male seaweed farmers access to larger plots of land, enabling them to scale up their operations and improve economic returns.

To safeguard the future of this sector, the long-term impacts of climate change and health issues on seaweed farming should be addressed through sustainable practices and health interventions.

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